

AMENDMENTS TO THE DRAWINGS:

One replacement sheet of drawings containing Fig. 4 is attached to this paper and includes changes to Fig. 4 which are discussed below in the remarks.

The replacement sheet of drawings containing Fig. 4 replaces the original sheet of drawings containing Fig. 4 filed with the application on October 28, 2003.

REMARKS

In accordance with the foregoing, Fig. 4 and claims 1 and 24 have been amended, claims 5 and 8-23 have been canceled, and new claims 30-31 have been added. No new matter is presented in this amendment.

Canceled claims 5 and 23 were withdrawn from consideration as being directed to the elected invention of Group I but not being readable on the elected species of Species II (Fig. 4).

Canceled claims 8-22 were withdrawn from consideration as being directed to the non-elected invention of Group II.

Claims 1-4, 6-7, and 24-31 are pending, with claims 1 and 24 being independent. Claims 1-4, 6-7, and 24-29 are under consideration. Claims 1-4, 6-7, 24-25, and 27-29 were rejected, and claims 24 and 26 were objected to. New claims 30-31 have not yet been considered.

Fig. 4 has been amended to correct spelling errors by changing "amorphous silicone" to "amorphous silicon," and changing "crystattine silicone" to "crystalline silicon."

Entry of Amendment After Final Rejection

It is submitted that entry of this Amendment After Final Rejection is proper under 37 CFR 1.116 and MPEP 714.12 and 714.13 because the amendment amends Fig. 4 to correct spelling errors; cancels withdrawn claims 5 and 8-23 as required by the Examiner and MPEP 821.01; and amends claims 1 and 24 to correct informalities identified by the Examiner for the first time in the final Office Action of November 1, 2005, with respect to language that was present in claim 1 as originally filed; and amends 1 claim and adds new claims 30-31 to distinguish over two references cited by the Examiner for the first time in the final Office Action of November 1, 2005. Amended claim 1 and new claims 30-31 are necessary to distinguish over the two newly references, and were not earlier presented because these two references were cited for the first time in the final Office Action of November 1, 2005. Accordingly, it is respectfully requested that this Amendment After Final Rejection be entered.

Regardless of whether this Amendment After Final Rejection is entered, it is respectfully requested that the Examiner indicate whether the arguments with respect to claims 24-29 are persuasive, and if they are not persuasive, why they are not persuasive.

Objections to the Claims

Claims 1 and 24 were objected to because of the informalities identified on page 2 of the Office Action of November 1, 2005, relating to the limitation "wherein an area surrounded by the primary grain boundaries" in claims 1 and 24. Claims 1 and 24 have been amended to eliminate the informalities identified by the Examiner, and it is respectfully requested that the objection to claims 1 and 24 be withdrawn.

This issue of informalities relating to the limitation "wherein an area surrounded by the primary grain boundaries" in claims 1 and 24 was raised by the Examiner for the first time in the Office Action of November 1, 2005. However, this limitation was present in claim 1 as originally filed, such that this issue should have been raised by the Examiner in the first Office Action on the merits, which was the Office Action of January 19, 2005. In light of this, it is submitted that it would not be appropriate for the Examiner to refuse to enter this Amendment After Final Rejection on the grounds that the amendments to claims 1 and 24 made to eliminate these informalities present new issues requiring further consideration or search.

Claim Rejections Under 35 USC 102

Claims 1, 2, 4, and 6 were rejected under 35 USC 102(b) as being anticipated by Zhang et al. (Zhang) (U.S. Patent No. 6,451,638). This rejection is respectfully traversed insofar as it may be deemed to be applicable to claims 1, 2, 4, and 6 in their present form and to new dependent claims 30-31 depending from independent claim 1.

Independent claim 1 now recites that "the area does not contain any substance added to promote crystallization of silicon in the area." It is submitted that Zhang does not disclose this feature of claim 1 because Fig. 1A of Zhang shows that Zhang deposits island-like nickel regions 2 on an amorphous silicon film 1 to promote crystallization of the amorphous silicon film to obtain a polycrystalline silicon film, and nickel remains in the polycrystalline silicon film as shown in Fig. 8 and described in column 10, lines 16-34, of Zhang.

Furthermore, new dependent claim 30 depending from independent claim 1 recites that "the area contains an amorphous silicon portion," and new dependent claim 31 depending from new dependent claim 30 recites that "the grains of polycrystalline silicon extend from the

amorphous silicon portion in the area to the primary grain boundaries surrounding the area." It is submitted that Zhang does not disclose these features of claims 30-31.

Since Zhang does not disclose the features of claims 1 and 30-31 discussed above, it is submitted that claims 1 and 30-31 patentably distinguish over Zhang in the sense of 35 USC 102(b), and it is respectfully requested that the rejection of claim 1 under 35 USC 102(b) as being anticipated by Zhang be withdrawn.

With respect to claims 2, 4, and 6, notwithstanding the position taken by the Examiner, it is noted that dependent claims 2, 4, and 6 depend from independent claim 1, and thus recite all of the features recited in claim 1 together with further features of the present invention.

Accordingly, it is submitted that claims 2, 4, and 6 are patentable over Zhang for at least the reasons discussed above that claim 1 is patentable thereover, and it is respectfully requested that the rejection of claims 2, 4, and 6 under 35 USC 102(b) as being anticipated by Zhang be withdrawn.

Claims 1, 2, 3, and 6 were rejected under 35 USC 102(e) as being anticipated by Yamazaki et al. (Yamazaki) (U.S. Patent No. 6,528,820). This rejection is respectfully traversed insofar as it may be deemed to be applicable to claims 1, 2, 3, and 6 in their present form and to new dependent claims 30-31 depending from independent claim 1.

Independent claim 1 now recites that "the area does not contain any substance added to promote crystallization of silicon in the area." It is submitted that Yamazaki does not disclose this feature of claim 1 because Fig. 1A of Yamazaki shows that Yamazaki deposits nickel elements 204 on an amorphous silicon film 203 to promote crystallization of the amorphous silicon film to obtain a polycrystalline silicon film, and nickel remains in the polycrystalline silicon film as described in column 3, line 61, through column 4, line 8, of Yamazaki.

Furthermore, new dependent claim 30 depending from independent claim 1 recites that "the area contains an amorphous silicon portion," and new dependent claim 31 depending from new dependent claim 30 recites that "the grains of polycrystalline silicon extend from the amorphous silicon portion in the area to the primary grain boundaries surrounding the area." It is submitted that Yamazaki does not disclose these features of claims 30-31.

Since Yamazaki does not disclose the features of claims 1 and 30-31 discussed above, it is submitted that claims 1 and 30-31 patentably distinguish over Yamazaki in the sense of 35

USC 102(e), and it is respectfully requested that the rejection of claim 1 under 35 USC 102(e) as being anticipated by Yamazaki be withdrawn.

With respect to claims 2, 3, and 6, notwithstanding the position taken by the Examiner, it is noted that dependent claims 2, 3, and 6 depend from independent claim 1, and thus recite all of the features recited in claim 1 together with further features of the present invention.

Accordingly, it is submitted that claims 2, 3, and 6 are patentable over Yamazaki for at least the reasons discussed above that claim 1 is patentable thereover, and it is respectfully requested that the rejection of claims 2, 3, and 6 under 35 USC 102(e) as being anticipated by Yamazaki be withdrawn.

Claims 24, 25, 27, and 28 were rejected under 35 USC 102(e) as being anticipated by Oana et al. (Oana) (U.S. Patent Application Publication No. 2003/0071312). This rejection is respectfully traversed.

The Examiner considers Fig. 5 of Oana to disclose "primary grain boundaries, wherein adjacent ones of the primary grain boundaries are not parallel to each other" as recited in claim 24 as indicated on the marked-up copy of Fig. 5 of Oana attached to the Office Action. The Examiner considers Fig. 6 of Oana to disclose the feature "wherein an area surrounded by the primary grain boundaries is larger than $1\text{ }\mu\text{m}^2$ " recited in claim 24. The Examiner also apparently considers Fig. 5 of Oana to disclose the feature "wherein polycrystalline silicon grains extend to the primary grain boundaries from an amorphous silicon portion in the area" recited in claim 24, although the Examiner did not explain why he considers this feature to be shown in Fig. 5 of Oana.

However, it is not seen where Fig. 5 of Oana shows "primary grain boundaries" as recited in claim 24 as alleged by the Examiner. The word "primary" does not appear in Oana. The word "boundaries" appears only three times in Oana—paragraph [0006], line 8 ("boundaries between crystal grains"); paragraph [0010], line 3 ("boundaries of crystal grains"); and paragraph [0045], line 9 ("channel boundaries").

Fig. 5 of Oana shows that four octagonal single-crystal grains are formed in each area where an energy beam having the intensity profile shown in Fig. 4 of Oana irradiates an amorphous silicon film in the pattern shown in Fig. 3 of Oana. Each of the octagonal single-crystal grains crystallizes beginning at a melting threshold intensity point E_{mth} near a minimum

intensity point Emin, and the crystallization proceeds towards a maximum intensity point Emax. The areas between the minimum intensity point Emin and the melting threshold intensity point Emth do not melt and thus do not crystallize, thereby remaining non-crystalline silicon portions, i.e., amorphous silicon portions. Each of these amorphous silicon portions is surrounded by four octagonal single-crystal grains, and is shown as a hatched square in Fig. 5 of Oana. These amorphous silicon portions will be called square minimum-intensity areas for the purposes of this discussion. Fig. 5 of Oana also shows square areas at points where the beam patterns touch as shown in Fig. 4 of Oana which are also non-crystalline portions, i.e., amorphous silicon portions. These square areas will also be called square minimum-intensity areas for the purposes of this discussion, although the intensity in these areas actually varies from the minimum intensity Emin to the melting threshold Emth as shown in Figs. 4-5 of Oana.

Fig. 5 of Oana shows square areas centered at the maximum intensity point Emax and surrounded by four octagonal single-crystal grains. These square areas will be called square maximum-intensity areas for the purposes of this discussion. These square maximum-intensity areas are apparently described as follows in paragraph [0042], lines 1-8, of Oana:

In the areas in which the temperature of semiconductor film is highest (corresponding to areas receiving the highest irradiation energy and, correspondingly, to the areas in which the horizontal growth of crystallization proceeds), a plurality of crystals which have different or crossed crystallization growth direction collide with one another, and their contacting areas form the area of fine crystals or the borderline of crystals.

The meaning of this passage of Oana is not entirely clear, but it appears that the statement "their contacting areas form the area of fine crystals" may arguably be considered to mean that the square maximum-intensity areas contain "polycrystalline silicon grains" as recited in claim 24.

There are three kinds of boundaries shown in Fig. 5 of Oana—Type I boundaries between the octagonal single-crystal grains, which are simple grain boundaries, not "primary grain boundaries" as recited in claim 24; Type II boundaries between the octagonal single-crystal grains and the square minimum-intensity areas; and Type III boundaries between the octagonal single-crystal grains and the square maximum-intensity areas. The designations Type I, Type II, and Type III do not appear in Oana, but are being adopted for the purposes of this discussion.

The "[a]rea surrounded by primary grain boundaries" indicated by the Examiner on the marked-up copy of Fig. 5 attached to the Office Action is in fact surrounded by eight Type I boundaries between octagonal single-crystal grains which are simple grain boundaries, not "primary grain boundaries" as recited in claim 24 as alleged by the Examiner, eight Type II boundaries between octagonal single-crystal grains and square minimum-intensity areas, and four Type III boundaries between octagonal single-crystal grains and square maximum intensity areas. Accordingly, it is submitted that the "[a]rea surrounded by primary grain boundaries" indicated by the Examiner on the marked-up copy of Fig. 5 attached to the Office Action is not in fact "an area surrounded by the primary grain boundaries" as recited in claim 24 as alleged by the Examiner.

Furthermore, the "[a]rea surrounded by primary grain boundaries" indicated by the Examiner on the marked-up copy of Fig. 5 attached to the Office Action includes four octagonal single-crystal grains and one square minimum-intensity area or amorphous silicon portion. Thus, even if this area identified by the Examiner were surrounded by "primary grain boundaries" as recited in claim 24 as alleged by the Examiner, it is submitted that this area does not contain "polycrystalline silicon grains" as recited in claim 24, and thus does not provide the feature "wherein polycrystalline silicon grains extend to the primary grain boundaries from an amorphous silicon portion in the area" recited in claim 24 as alleged by the Examiner.

Although the square maximum-intensity areas surrounded by the Type III boundaries may arguably be considered to contain "polycrystalline silicon grains" as recited in claim 24 in light of paragraph [0042], lines 1-8, of Oana as discussed above, the square maximum-intensity areas do not include "an amorphous silicon portion" as recited in claim 24, and thus do not provide the feature "wherein polycrystalline silicon grains extend to the primary grain boundaries from an amorphous silicon portion in the area" recited in claim 24.

For at least the reasons discussed above, it is submitted that Oana does not disclose "primary grain boundaries, wherein adjacent ones of the primary grain boundaries are not parallel to each other, wherein an area surrounded by the primary grain boundaries is larger than $1\text{ }\mu\text{m}^2$, and wherein polycrystalline silicon grains extend to the primary grain boundaries from an amorphous silicon portion in the area" as recited in claim 24. Accordingly, it is respectfully requested that the rejection of claim 24 under 35 USC 102(e) as being anticipated by Oana be withdrawn.

With respect to claims 25, 27, and 28, notwithstanding the position taken by the Examiner, it is noted that dependent claims 25, 27, and 28 depend from independent claim 24, and thus recite all of the features recited in claim 24 together with further features of the present invention.

Accordingly, it is submitted that claims 25, 27, and 28 are patentable over Oana for at least the reasons discussed above that claim 24 is patentable thereover, and it is respectfully requested that the rejection of claims 25, 27, and 28 under 35 USC 102(e) as being anticipated by Oana be withdrawn.

Claim Rejections Under 35 USC 103

Claim 7 was rejected under 35 USC 102(e) as being anticipated by Zhang or, in the alternative, under 35 USC 103(a) as obvious over Akimoto et al. (Akimoto) (U.S. Patent Application Publication No. 2003/0197666) in view of Zhang. This rejection is respectfully traversed insofar as it may be deemed to be applicable to claim 7 in its present form.

Notwithstanding the position taken by the Examiner, it is noted that dependent claim 7 depends indirectly from independent claim 1, and thus recites all of the features recited in claim 1 together with further features of the present invention.

Accordingly, it is submitted that claim 7 is patentable over Zhang and Akimoto for at least the reasons discussed above that claim 1 is patentable over Zhang, and it is respectfully requested that the rejection of claim 7 under 35 USC 102(e) as being anticipated by Zhang or, in the alternative, under 35 USC 103(a) as obvious over Akimoto in view of Zhang, be withdrawn.

Claim 7 was rejected under 35 USC 102(e) as being anticipated by Yamazaki or, in the alternative, under 35 USC 103(a) as obvious over Akimoto in view of Yamazaki. This rejection is respectfully traversed insofar as it may be deemed to be applicable to claim 7 in its present form.

Notwithstanding the position taken by the Examiner, it is noted that dependent claim 7 depends indirectly from independent claim 1, and thus recites all of the features recited in claim 1 together with further features of the present invention.

Accordingly, it is submitted that claim 7 is patentable over Yamazaki and Akimoto for at least the reasons discussed above that claim 1 is patentable over Yamazaki, and it is

respectfully requested that the rejection of claim 7 under 35 USC 102(e) as being anticipated by Yamazaki or, in the alternative, under 35 USC 103(a) as obvious over Akimoto in view of Yamazaki, be withdrawn.

Claim 29 was rejected under 35 USC 102(e) as being anticipated by Oana (not Zhang as indicated) or, in the alternative, under 35 USC 103(a) as obvious over Akimoto in view of Oana. This rejection is respectfully traversed.

Notwithstanding the position taken by the Examiner, it is noted that dependent claim 29 depends indirectly from independent claim 24, and thus recites all of the features recited in claim 24 together with further features of the present invention.

Accordingly, it is submitted that claim 29 is patentable over Oana and Akimoto for at least the reasons discussed above that claim 24 is patentable over Oana, and it is respectfully requested that the rejection of claim 29 under 35 USC 102(e) as being anticipated by Oana (not Zhang as indicated) or, in the alternative, under 35 USC 103(a) as obvious over Akimoto in view of Oana, be withdrawn.

Allowable Subject Matter

The indication that claim 26 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims, is acknowledged. However, claim 26 has not been rewritten in independent form as suggested by the Examiner at this time because independent claim 24 from which claim 26 depends is also considered to be allowable for the reasons discussed above.

Conclusion

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

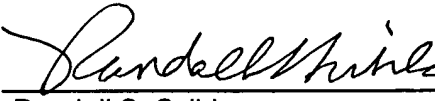
Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this paper, please charge the same to our Deposit Account No. 503333.

Respectfully submitted,

STEIN, MCEWEN & BUI, LLP

Date: 01/26/06

By: 
Randall S. Svihla
Registration No. 56,273

1400 Eye St., NW
Suite 300
Washington, D.C. 20005
Telephone: (202) 216-9505
Facsimile: (202) 216-9510

Attachment